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ABSTRACT

Instructional time to high proficiency or response time to high proficiency performance can be viewed as linearly related to the effective complexity of the task/display combination which is the essence of instruction or of performance. This proposition is concretely illustrated for bar graph-using performance of 4th and 6th graders who under most conditions manifest quite accurate performance. Mean response time (T) is made a linear function of the measure of task/display effective complexity. A model is presented wherein this measure of complexity represents the sum of the weights of the parameters pertinent to three physical operations, one or more of which is pertinent to performing either of two information processing tasks with respect to either of two bar-graphic display forms. It is contended that effective complexity could be evaluated for any sufficiently analytic information display form using the approach sketched. It is noted that in any such analysis the measure of complexity remains a postulation until empirically verified using suitable new data. (Author/BW)

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Bar Graph-Using Operations and Response Time

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BAR GRAPH-USING OPERATIONS AND RESPONSE TIME

Joseph F. Follettie

ABSTRACT

Instructional time to high proficiency or response time to high proficiency performance can be viewed as linearly related to the effective complexity of the task/display combination which is the essence of instruction or of performance. This proposition is concretely illustrated for bar graph-using performance of 4th and 6th graders who under most conditions manifest quite accurate performance. Mean response time (T) is made a linear function of θ--the measure of task/display effective complexity. A model is presented wherein θ represents the sum of the weights of the parameters pertinent to three physical operations, one or more of which is pertinent to performing either of two information processing tasks with respect to either of two bar-graphic display forms. It is contended that effective complexity could be evaluated for any sufficiently analytic information display form using the approach sketched. It is noted that in any such analysis θ remains a postulation until empirically verified using suitable new data.

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BAR GRAPH-USING OPERATIONS AND RESPONSE TIME

Joseph F. Follettie

How many words is a picture worth? For some, the answer is "a thousand;" for others, "zero" (Fleming, 1979). All possible answers are correct in suitable context. The worth of a picture turns on whether its analog features are pertinent to an instructional objective, how many such features are pertinent, etc. It is a weak science and technology that treats pictoriality in yes-no terms when investigating pictorial effects on acquisition or performance. The science and technology also must be considered weak that treats instruction itself as mush or yard goods to be ladled out by the page, period, lesson, etc. There must be informational or work-levying features of instruction that are more pertinent to its characterization as the investigatory focus than its surface extent. The unitization of instruction such that one unit entails one unit of instructional resource must depend on something more fundamental than paper used or chunkings based on intuition and administrative convenience. This paper explores such unitization under two restrictions. First, the illustrated subject matter domain is restricted to bar graph-using. Second, the illustrated effects domain is restricted to essentially post-acquisition performance, on the assumption that the performance of work recapitulates the acquistion of performance of work regarding time expenditures.

The dimension of time has two useful manifestations in schooling--instructional time and response time. Instructional time is an acquisition-referenced variable. It signifies the instructional resource that must be expended to render a student suitably proficient for knowledge or skill conveyed by given instruction under given conditions. Response time is a performance-referenced variable. It signifies the effort a student must expend to manifest knowledge in light of its relational structure or skill in light of its operational (procedural) structure. The paper's objective is to relate response time to certain features of information processing tasks involving the use of common forms of bar graphs. The features sought may be viewed as subject matter units, where the number of such units predicts instructional time investments to desired proficiency or, beyond this, response time differentials useful to characterizing subject matters for effective complexity--a concept of central concern to this paper.

The effective complexity of an information display--its formally derived probable difficulty under specified conditions--is only partially determined by display characteristics per se. Effective complexity is a joint function of display characteristics and those of an information processing task that is to be performed with respect to the display. Whether the objective is that new information be understood or its acquisition demonstrated, both instructional time to proficiency and response time during a proficiency demonstration should vary with variation in effective complexity. This paper seeks to give substance to this creed in the restricted domain of bar graph-using.

The choice between alternative leviable tasks is critical to the specification of effective complexity. Two displays might differ for some pertinent characteristics--for instance semantic complexity--and yet be equal for effective complexity because the levied task on which effective complexity is calculated does not entail dealing with their differential complexity. Consider the following illustration:

Display 1	Display 2
A is one unit north of B.	A is one unit north of B.
B is one unit north of C.	B is one unit west of C.
C is two units north of D.	C is two units south of D.

Task 1. Map B's location with respect to A.

Task 2. Map the locations of A, B, C, and D with respect to each other.

The two displays are similar for syntactic complexity but differ somewhat for semantic complexity--the set of relations addressed by Task 2. A useful calculus for determining the effective complexity of such displays would indicate that the Task 1/Display 1 and Task 1/Display 2 combinations do not differ for effective complexity, but that the effective complexity of the Task 2/Display 2 combination is greater than that for the Task 2/Display 1 combination.

Extended discourse selections--e.g., 500 words of text--of instructional interest typically fluctuate for semantic structure and so for the form that pertinent information processing will take. Such fluctuations tend to be subject matter imposed; they cannot be smoothed out just to serve an objective to render selections evaluable for effective complexity. In such instances the quest for suitable formally derived subject matter units might be aided by prior determinations of instructional time to criterion for each such selection.

Conversely, analytic information displays such as numerical tables and bar graphs tend to be so conventionalized for format that their structures are predictable. Such displays invite at most a handful of alternative information processing tasks, with each task involving just a few pertinent operations. The paper presents task analyses yielding unweighted operations counts for the major bar graph-using tasks and a preliminary model wherein such operations are so weig'ced that response time T--the mean time used by a representative sample of 6th graders when performing a task--is a linear function of the number of weighted operations θ. For the task/display combinations examined, θ signifies postulated effective complexity of the combination.

PRELIMINARIES

An earlier paper (Follettie, 1980) explored the antecedents of task/structure effects for numerical tables; for these displays, effective complexity depends primarily on the operations one must perform when processing row and/or column margins consonant with the requirements of a specified table-using task. Herein, a similar formulation is presented for bar graphs--but with the difference that the present formulation is data-driven. In the pertinent investigation (Follettie, 1978a; 1978b), a range of structures within a framework of two generic bar-graphic taxons is crossed with two generic bar graph-using tasks. One of these tasks is taxon-sensitive; the other is not. The tasks are superlative and absolute retrieval.

Superlative retrieval from a bar graph occurs when a user retrieves a label signifying the Xest (largest, smallest) bar in an array. This task is taxon-insensitive. Absolute retrieval occurs when a bar's "producer" descriptor is specified and a user's response entails magnitude assessment. This task is taxon-sensitive. When the display is a conventional bar graph (Taxon 1), the task asks a user to select a specified bar and then to assess its magnitude using the graph's scale. Conversely, when the display is an augmented bar graph (one wherein the magnitudes of bars are indicated by number-labelling each bar, Taxon 2), it is unnecessary to read the scale. Instead, one notes the number signifying the bar's magnitude. An augmented bar graph combines the features of a conventional bar graph and a numerical table. It supplies analog information (visual indications of bar height) together with digital information (number labels signifying bar height).

Superlative retrieval from a conventional bar graph is easier--and indeed more natural--than absolute retrieval; absolute retrieval is easier when the display is a numerical table; the tasks are about equally easy when the display is an augmented bar graph (Follettie, 1978a; 1978b).

Four task/taxon combinations are of interest:

- Absolute retrieval/conventional bar graph--ABS/CON or AC.
- Superlative retrieval/conventional bar graph--SUP/CON or SC.
- Absolute retrieval/augmented bar graph--ABS/AUG or AA.
- Superlative retrieval/augmented bar graph--SUP/AUG or SA.

The cited findings suggest that the first of these combinations has a higher effective complexity than the others, no doubt due to the fact that only the first combination entails scale-using. Under each of the four headings, the formulation addresses seven previously studied structures:

- A 6-bar graph with clusters (3x2) or without (6x1).
- A 12-bar graph with clusters (6x2) or without (12x1).
- A 24-bar graph with clusters (12x2 or 6x4) or without (24x1).

DATA BASE

Although mean accuracies are presented, the most pertinent data are mean response times for performance in the context of each of 28 task/taxon/structure combinations--2 tasks x 2 taxons x 7 structures. Based on response time per operation, three of the task/taxon combinations--SUP/CON, ABS/AUG, SUP/AUG--can be placed under a single heading--non-scale-using combinations. Also based on response time per operation, the seven structures are categorized under three structure class headings.

Participants in a first phase of the study used 6- and 12-bar graphs; those in a second phase, 24-bar graphs. In each phase, 16 4th and 16 6th grades participated under essentially one-on-one data collection conditions. First phase participants responded to 32 pages of presently pertinent materials; second phase participants, 24. A page consisted of two graphs reflecting the same taxon, structure, and bar orientation. Two queries accompanied each graph. The four queries on a page reflected the same generic task. For each investigated combination, one page featured bars in horizontal orientation; another, bars in vertical orientation. Page sequencing was randomized. Participants were seen in 30-minute sessions, one per day, for as many consecutive school days as were required to complete the work. Data collection conditions represented a compromise between typical classroom and laboratory conditions.

Mean accuracy was high under most investigated conditions. Mean response time was more variable. Mean accuracy (A) and mean response time (T) values, by grade, task/taxon combination, and structure are presented in Table 1.[1] In the table, performance is averaged across bar orientation. Hence, each entry is based on responses to eight queries by each of 16 grade level participants. The accuracy entries reflect proportions of responses correct. The time entries--fractions of a minute--when multiplied by 60 reflect time in seconds per response. Mean response times ranged from 6+ to 31+ seconds.

To be demonstrated, when response time is plotted against weighted operations, one of the structure class means of 4th graders is "unduly out of line." For this reason, the formulation relies primarily on 6th grader data.

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[1] Tables 2 and 3 of Follettie (1978a, 1978b) present mean accuracy values (A) and mean values of accuracy score divided by response time score (A/T). One can approximate mean response times from these data-- $T \doteqdot A/(A/T)$. Precise determination of mean response times entails a reexamination of the data. The T values in Table 1 are based on the reexamination.

Table 1

Mean Accuracy and Response Time, by Grade Level, for 28 Bar-Graphic Task/Taxon/Structure Combinations

Grade	Structure Class	Structure	Accuracy AC	Accuracy AA	Accuracy SC	Accuracy SA	Accuracy Mean of AA+SC+SA	Response Time (Min) AC	Response Time (Min) AA	Response Time (Min) SC	Response Time (Min) SA	Response Time (Min) Mean of AA+SC+SA
4	A	6x1	.740	1.000	.980	.990	.990	.290	.144	.176	.184	.168
		12x1	.560	.975	.990	.980	.982	.283	.158	.142	.161	.154
		Mean	.650	.987	.985	.985	.986	.287	.151	.159	.173	.161
	B	3x2	.505	.895	.910	.915	.907	.407	.268	.266	.278	.271
		6x2	.625	.990	.910	.925	.942	.390	.231	.259	.236	.242
		12x2	.945	.990	.950	.930	.957	.417	.320	.291	.354	.322
		24x1	.665	1.000	1.000	.975	.992	.473	.311	.300	.259	.290
		Mean	.685	.969	.942	.936	.949	.422	.283	.279	.281	.281
	C	6x4	.755	.990	.935	.890	.938	.520	.326	.319	.296	.314
6	A	6x1	.835	.900	.985	.975	.953	.201	.108	.121	.135	.121
		12x1	.690	1.000	.990	.990	.993	.230	.110	.105	.130	.115
		Mean	.762	.950	.987	.982	.973	.216	.109	.113	.133	.118
	B	3x2	.600	.975	.870	.945	.930	.293	.186	.201	.203	.197
		6x2	.840	.985	.920	.915	.940	.355	.188	.200	.207	.198
		12x2	.935	1.000	.980	.925	.968	.357	.235	.246	.267	.250
		24x1	.625	1.000	.990	.990	.993	.370	.251	.217	.197	.222
		Mean	.750	.990	.940	.944	.958	.344	.215	.216	.219	.217
	C	6x4	.700	.965	.960	.875	.933	.425	.274	.292	.287	.284

PHYSICAL OPERATIONS

The formulation distinguishes between physical (external, raw, unweighted) and weighted (internal, information processing) operations. Counts of physical operations are selective. Bar location and scaling operations are counted. Noting a numerical value at the end of a bar indicating its magnitude is considered a minor extension of a bar location operation and is not counted.

A bar graph is an m x n structure wherein m denotes the number of bar clusters in the graph and n the number of bars in a cluster. A graph having no clusters is said to have m 1-bar clusters. Herein m varies from 3 to 24 and n from 1 to 4. A graph wherein n=1 is a one-factor graph. One wherein n>1 is a two-factor graph.

The four task/taxon combinations between them encompass only three physical operations sufficiently challenging to merit acknowledgement. These are:

#1 Locate the ith cluster.

#2 Locate the jth bar (in the ith cluster).

#3 Scale the jth bar.

For the absolute retrieval/conventional graph combination (AC), #1 is mandatory for all structures, #2 for the 3x2, 6x2, 12x2, and 6x4 structures, and #3 for all structures. For all other combinations (SC, AA, SA), #1 is mandatory for all structures and #2 for 3x2, 6x2, 12x2, and 6x4; #3 is required for none of the structures. In essence, then, this gross physical analysis suggests operations counts as follows:

- For AC:
    - For 6x1, 12x1, 24x1 structures, 2 operations.
    - For 3x2, 6x2, 12x2, 6x4 structures, 3 operations.
- For SC, AA, and SA:
    - For 6x1, 12x1, 24x1 structures, 1 operation.
    - For 3x2, 6x2, 12x2, 6x4 structures, 2 operations.

These counts do not compensate for variations in the size of m or n. They accept scale-using as one operation under all investigated conditions. Let Ø denote counts of physical operations. The pertinent 6th grader response times are presented in Table 2, with Ø the basis for defining structure class and the "other" classification

Table 2

Mean Structure Class Response Times for AC and Other Combinations, Where Ø Defines Structure Class

Structure Class	Structure	AC		Other	
		Ø	T	Ø	T
A'	6x1	2	.201	1	.121
	12x1	2	.230	1	.115
	24x1	2	.370	1	.222
	Mean	2	.267	1	.153
B'	3x2	3	.293	2	.197
	6x2	3	.355	2	.198
	12x2	3	.357	2	.250
	6x4	3	.425	2	.284
	Mean	3	.357	2	.232

reflecting response time mean values for the SC + AA + SA combinations. T = f(Ø) is graphed in Figure 1, with the plotted points reflecting structure class means. The plot comes respectably close to linear form. However, note in Table 1 that structure classes defined on Ø place together some unlike structures. The 24x1 structure looks much more like B' structures for mean response time than like the other A' structures. The 6x4 structure looks unlike the other B' structures and should occur under a C' heading reflecting roughly 4 AC and 3 "other" operations. A weighting scheme is required that raises the operations inherent in the 24x1 structure to roughly 3 when the combination is AC and 2 when it is one of the others and that raises the operations inherent in the 6x4 structure to roughly 4 when the combination is AC and 3 when it is one of the others.

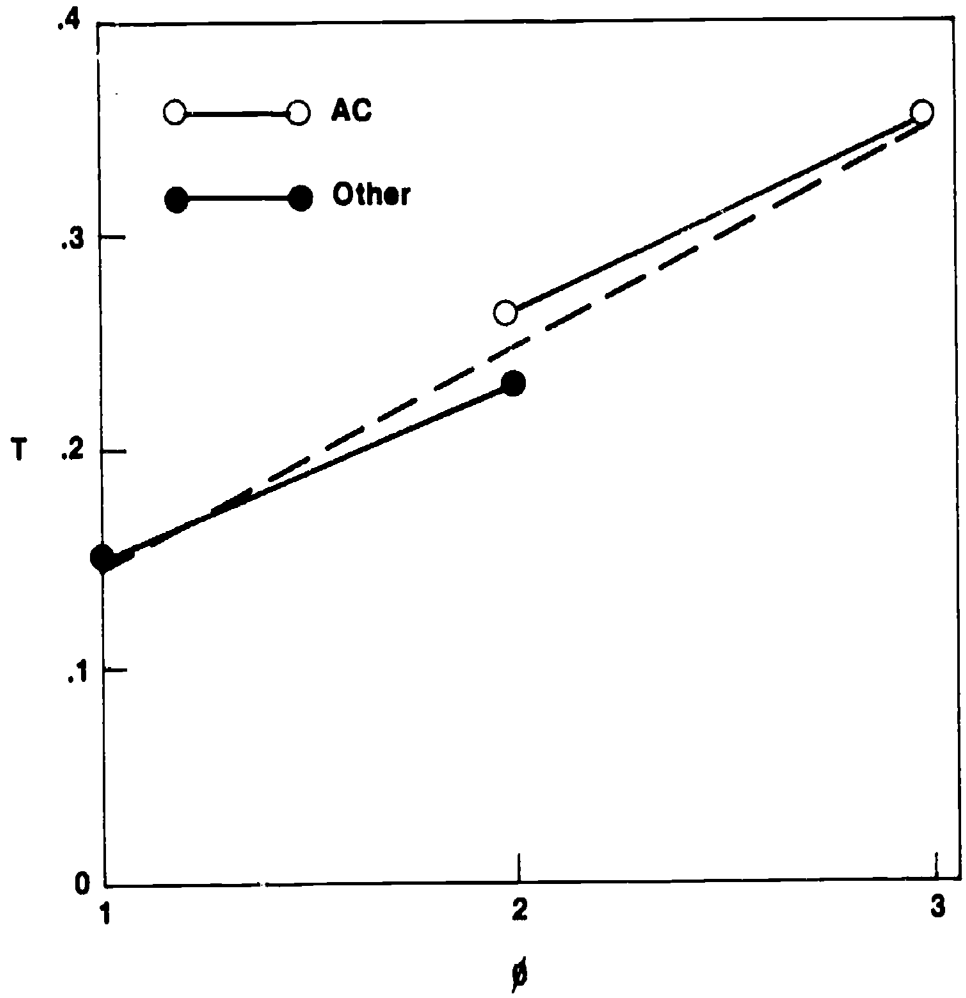

Figure 1. Mean response time (min) (T) as a function of number of physical operations (Ø).

PRELIMINARY WEIGHTING

T is not a straightforward linear function of the count of physical operations. At least part of the problem apparently is that operations #1 and #2 must be weighted to reflect (internal) information processing operations that vary with size of m and n--number of clusters and cluster size, respectively. Assumptions for purposes of preliminary weighting are:

1. If $m<13$, it is unnecessary to localize an appropriate region of m prior to locating an ith cluster. If $m<13$, the weight z on operation #1 is 1. If $m = 24$, it is necessary to perform the preliminary region-localizing operation; the weight z on operation #1 then is 2.

2. The internal processing operations w inherent in locating a jth bar (operation #2) is given by the expression $w = \log n/\log 2$ (signifying of course that $n = 2^w$). Therefore, the weight w on operation #1 is 0 when $n=1$ (2^0), 1 when $n=2$ (2^1), and 2 when $n=4$ (2^2).

Let -0- denote preliminarily weighted operations. z reflects the weight on #1, w on #2, and s on #3. Since no weighting assumption is made for #3, s=1 for AC and 0 for other combinations, as before. Weights by structure class defined on -0- are given in Table 3.

Table 3

Structure Classes and Their Weights, Where -0- Defines Structure Class

Structure Class	Structure(s)	AC -0- Weight				Other -0- Weight			
		z	w	s	Tot	z	w	s	Tot
A	6x1, 12x1	1	0	1	2	1	0	0	1
B	24x1	2	0	1	3	2	0	0	2
	3x2, 6x2, 12x2	1	1	1	3	1	1	0	2
C	6x4	1	2	1	4	1	2	0	3

Pertinent 4th and 6th grader response times are presented in Table 4. The basis for defining structure class is -0-; the "other" classification reflects response time mean values for the SC + AA + SA combinations. Response time per operation values also are given. These values should approach being constant within a grade level if T is a linear function of -0-. The most glaring departure from unit time per operation occurs in the 4th grader "other" data for structure class C (the 6x4 structure). The respondents acted as if the 6x4 structure for "other" combinations was a 2- rather than a 3-operation challenge. To a lesser extent, so did the 6th graders. These tendencies show up clearly in Figure 2, which graphs T = f(-0-).

The refined weighting scheme to be presented responds to departures from linearity of the 6th grader data in the region -0- = 3.

Table 4

Mean Structure Class Response Times and Response Times Per Operation for AC and Other Combinations, by Grade Level, Where -0- Defines Structure Class

Grade	Structure Class	Structure	AC			Other		
			-0-	T	T/-0-	-0-	T	T/-0-
4	A	6x1	2	.290	.145	1	.168	.168
		12x1	2	.283	.141	1	.154	.154
		Mean	2	.287	.143	1	.161	.161
	B	3x2	3	.407	.136	2	.271	.135
		6x2	3	.390	.130	2	.242	.121
		12x2	3	.417	.139	2	.322	.161
		24x1	3	.473	.158	2	.290	.145
		Mean	3	.422	.141	2	.281	.140
	C	6x4	4	.520	.130	3	.314	.105
6	A	6x1	2	.201	.100	1	.121	.121
		12x1	2	.230	.115	1	.115	.115
		Mean	2	.216	.108	1	.118	.118
	B	3x2	3	.293	.098	2	.197	.098
		6x2	3	.355	.118	2	.198	.099
		12x2	3	.357	.119	2	.250	.125
		24x1	3	.370	.123	2	.222	.111
		Mean	3	.344	.115	2	.217	.108
	C	6x4	4	.425	.106	3	.284	.095

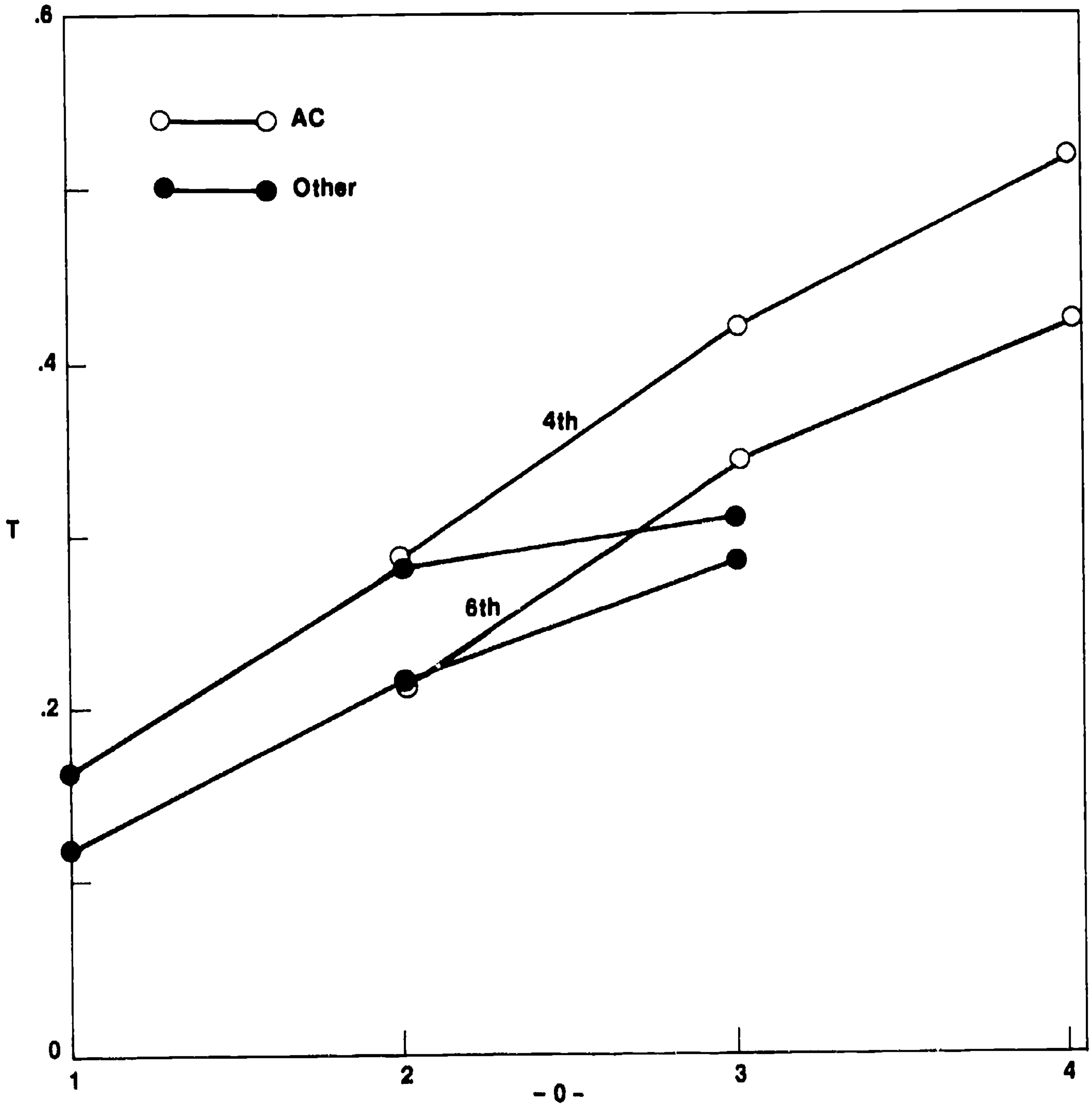

Figure 2. Mean response time (min) (T) as a function of number of preliminarily weighted operations (-0-), by grade level.

REFINED WEIGHTING

In the refined weighting scheme, z and w continue, respectively, to be functions of m and n; s (the weight of scale-using) becomes a joint function of m and n (or of the weights z and w).

Let $q = uv$, where u signifies the taxon and v the task and where $u=0$ for the augmented graph and $u=1$ for the conventional and $v=0$ for the superlative task and $v=1$ for the absolute. Hence, $q=0$ for all task/taxon combinations except ABS/CON, for which $q=1$. $q=0$ signifies that the scale-using operation (#3) is not pertinent; $q=1$, that it is.

The assumptions inherent in the refined weighting scheme take the following form:

- Operation #1. For $2<m<13$, $z = 1$.

  For $m>12$, $z = [\log(2m/3)/\log 2] - 2$.

- Operation #2. $w = (r^2+3r)/2(r+1)$, where $n = r^2$ and $r = \log n/\log 2$.

- Operation #3. For $q = 0$, $s = 0$.

  For $q = 1$, $s = \sqrt[3]{z+w}$

These assumptions are graphed in Figures 3-5. They stem from a desire to account for the data under the assumption that T should be a linear function of weighted operations.

In the scheme, $\theta = z + w + s$. Weights by structure class defined on θ are given in Table 5. $T = f(\theta)$ is graphed in Figure 6. Based on the refined weighting scheme, T now is a linear function of weighted operations. In effect:

$$\hat{T} = .099\theta + .019.$$

$\hat{T}$ values are shown together with their corresponding T values in Table 5. Expected values agree well with obtained values at the structure class level. Agreement is not as good at the structure level, but none of the obtained response time means for structures depart radically from "expectation."

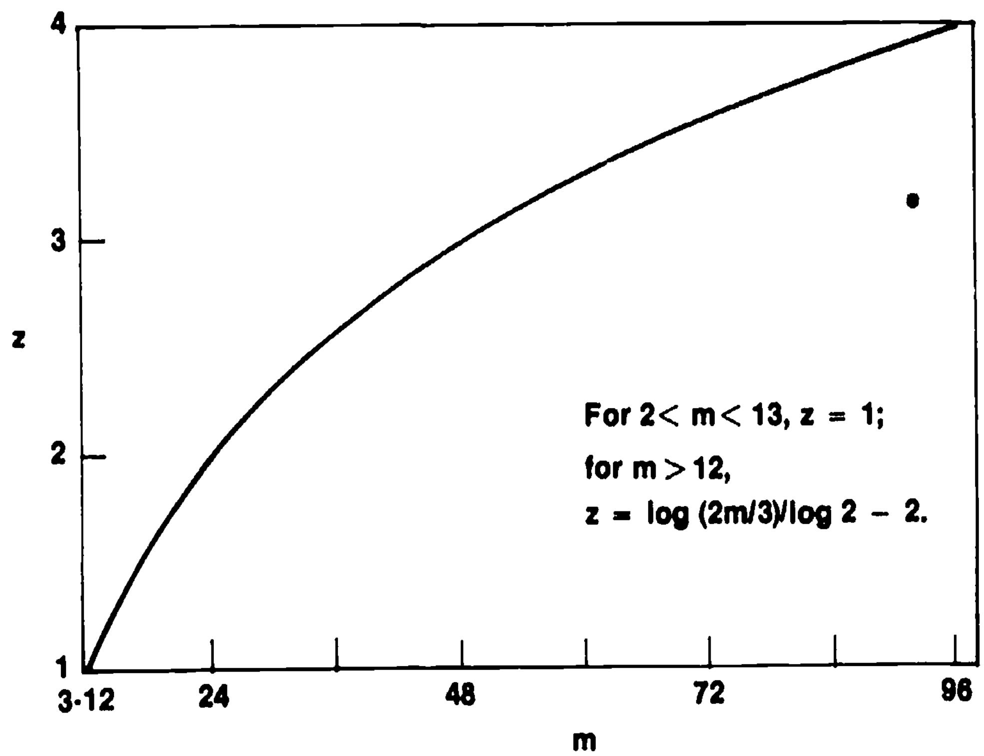

Figure 3. Postulated weighting (z) of number of clusters (m) in a bar graph.

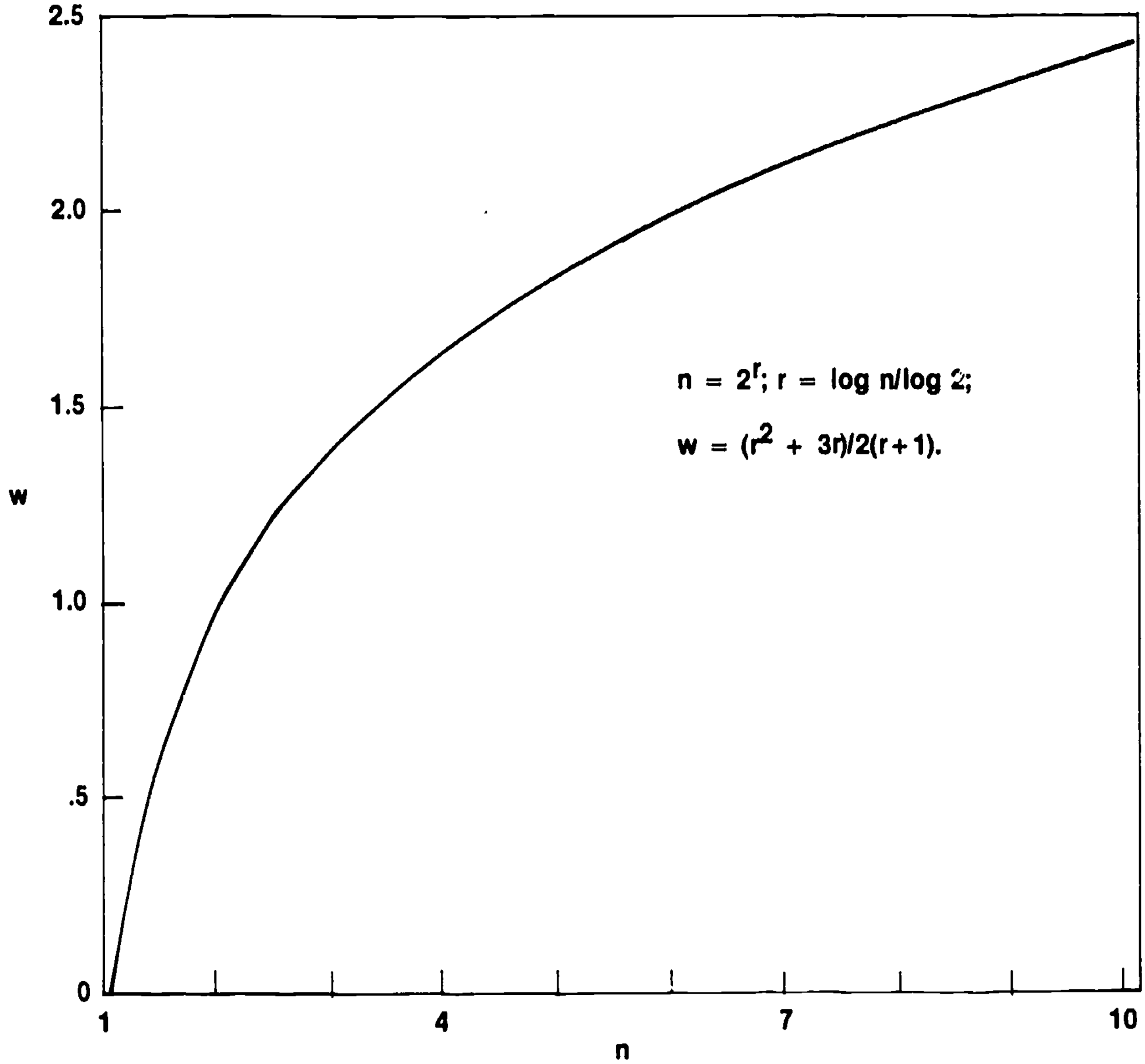

Figure 4. Postulated weighting (w) of number of bars in a cluster (n) for a bar graph.

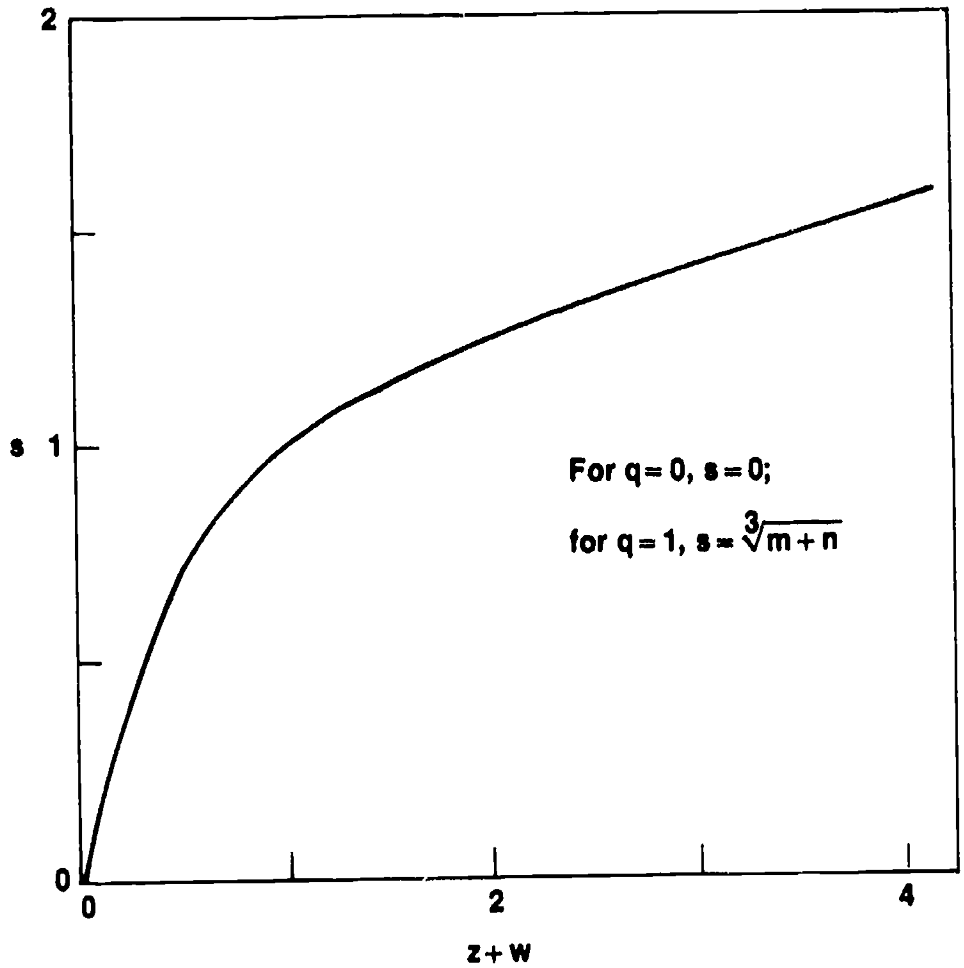

Figure 5. Postulated weighting (s) of the scale-using operation (#3) in a bar graph.

Table 5

Weighted Operations (θ) and Sixth Grader Obtained (T) and Expected ($\hat{T}$) Mean Response Times (Min) for Investigated Bar Graph Structures[a]

Structure	z	w	$\sqrt[3]{z+w}$	q=1 (AC)			q=0 (SC,AA,SA)		
				θ	T	$\hat{T}$	θ	T	$\hat{T}$
6x1	1	0	1	2	.201	.217	1	.121	.118
12x1	1	0	1	2	.230	.217	1	.115	.118
Mean				2	.216	.217	1	.118	.118
3x2	1	1	1.26	3.26	.293	.342	2	.197	.217
6x2	1	1	1.26	3.26	.355	.342	2	.198	.217
12x2	1	1	1.26	3.26	.370	.342	2	.220	.217
24x1	2	0	1.26	3.26	.357	.342	2	.250	.217
Mean				3.26	.344	.342	2	.217	.217
6x4	1	1.67	1.39	4.06	.425	.421	2.67	.284	.283

[a]Expected response times are based on the fitted expression $\hat{T} = .099\theta + .019$.

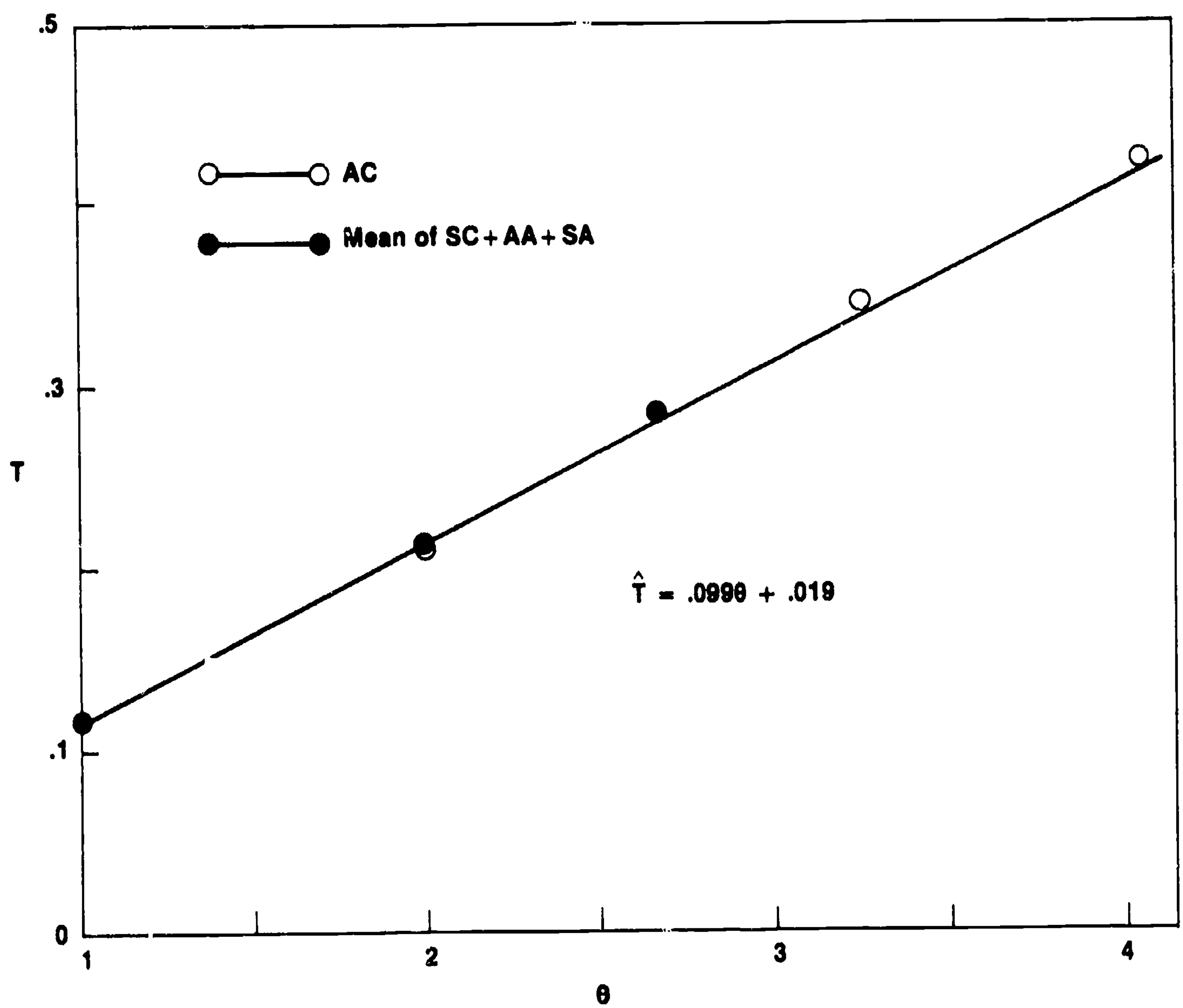

Figure 6. Mean response time (min) (T) as a function of number of weighted bar graph-using operations (θ). Data is for 6th graders.

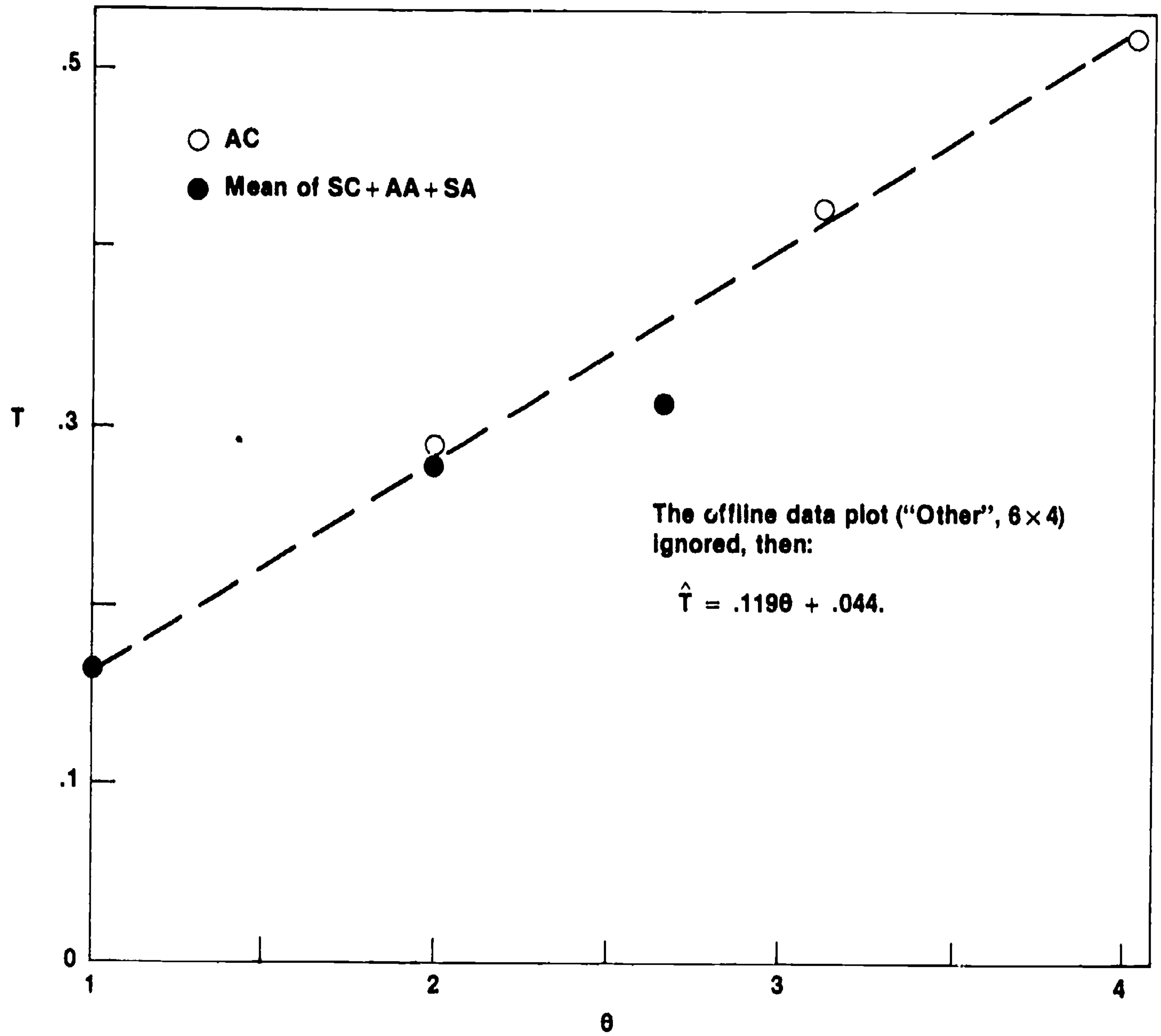

Figure 7. Mean response time (min) (T) as a function of number of weighted bar graph-using operations (θ). Data is for 4th graders.

Whereas Figure 6 reveals that T is a straightforward linear function of θ for the 6th graders, Figure 7 shows that this is so for the 4th graders only if the mean response time for the 6x4 structure in the context of the SC+AA+SA combinations is ignored. This mean ignored, then for the 4th graders:

$$T = .119\theta + .044.$$

The general form of a linear function is of course $Y = mX + k$. In the present situation, k can be interpreted as indicating the mean latency of response under any condition. Since $k = .019$ for 6th graders and .044 for 4th graders, the 4th graders on the average have latencies over twice as great as the 6th graders. They begin to respond only after something like 2.64 seconds ($.044 \times 60$) have elapsed, whereas the 6th graders begin to respond after something like 1.14 seconds. Values of the slope parameter for the two grades are $m = .099$ for the 6th graders and $m = .119$ for the 4th graders, which indicates that the 4th grader response times per se (when latency is removed from measured response time) are 20% greater on the average than those of 6th graders.

That T is a linear function of θ simply is a postulation based on the available data base. If it is so under the wider conditions the refined weighting scheme assumes, then T should be a linear function of θ when the structures listed in Table 6 are investigated under conditions paralleling those characterizing the available data base. Replicating the available data base would not suffice to render the conceptualization of θ tenable under wider conditions.

I have some reservations concerning the scheme. It probably is a mistake to drive $z = f(m)$ through the "points" $z=1$ when $m = 3\text{-}12$ and $z=2$ when $m=24$. I can't believe that z should be quite so high as 3.06 when $m=50$ and am not entirely sure that z should have the same value when $m=3$ as when $m=12$. Moreover, the notion that s should be a function of z and w (and so of m and n) is more convenient than compelling. But it is not the objective of the paper to expound a compelling theory concerning how θ relates to specified characteristics of the identified physical operations. Rather it is to illustrate how order might be teased out of chaos. This I hope the paper succeeds in doing. The orderliness that inheres in the response time means for the task/taxon/structure combinations studied goes appreciably unrevealed so long as one attends entirely to the surface manifestations inhering in the individual structures. Only when structure classes are formed in consequence of postulated "deeper than surface" manifestations does order begin to emerge.

The approach outlined above is applicable to a variety of task/taxon combinations involving well-formed analytic information displays. Whether it could usefully be applied when the information display consists of running text turns on the extent to which, first, text can be analyzed into structurally distinct semantic components and, second, the task(s) pertinent to processing each such component not only can be identified but consensually so.

Table 6

Weighted Operations (θ), by Task/Taxon Combination, for Representative Bar Graph Structures and Expected Sixth Grader Response Times ($\hat{T}$, in Sec)

Structure	z	w	$\sqrt[3]{z+w}$	AC		SC,AA,SA	
				θ	$\hat{T}$	θ	$\hat{T}$
4x1, 8x1, 12x1	1	0	1	2	13	1	7
18x1	1.58	0	1.16	2.74	17	1.58	11
4x2, 8x2, 12x2	1	1	1.26	3.26	21	2	13
24x1	2	0	1.26	3.26	21	2	13
4x3, 8x3, 12x3	1	1.40	1.34	3.74	23	2.40	15
18x2	1.58	1	1.37	3.95	25	2.58	16
36x1	2.58	0	1.37	3.95	25	2.58	16
4x4, 8x4, 12x4	1	1.67	1.39	4.06	25	2.67	17
16x3	1.41	1.40	1.41	4.22	26	2.81	18
4x5, 8x5, 12x5	1	1.86	1.42	4.28	27	2.86	18
15x4	1.32	1.67	1.44	4.43	27	2.99	19
24x2	2	1	1.44	4.44	28	3.00	19
48x1	3	0	1.44	4.44	28	3.00	19
4x6, 8x6, 12x6	1	2.01	1.44	4.45	28	3.01	19
16x4	1.41	1.67	1.45	4.53	28	3.08	19
4x7, 8x7, 12x7	1	2.14	1.46	4.60	28	3.14	20
20x3	1.74	1.40	1.46	4.60	28	3.14	20
4x8, 8x8, 12x8	1	2.25	1.48	4.73	29	3.25	20
60x1	3.32	0	1.49	4.81	30	3.32	21
30x2	2.32	1	1.49	4.81	30	3.32	21
4x9, 8x9, 11x9	1	2.35	1.49	4.84	30	3.35	21
20x4	1.74	1.67	1.51	4.92	30	3.41	21
4x10, 8x10, 10x10	1	2.43	1.51	4.94	30	3.43	22
30x3	2.32	1.40	1.55	5.27	32	3.72	23
25x4	2.06	1.67	1.55	5.28	33	3.73	23
40x2	2.74	1	1.55	5.29	33	3.74	23
80x1	3.74	0	1.55	5.29	33	3.74	23
50x2	3.06	1	1.60	5.66	35	4.06	25

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